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USER MANUAL

IC-3121

Industrial Controller

This document contains detailed electrical and mechanical information for the National Instruments IC-3121.

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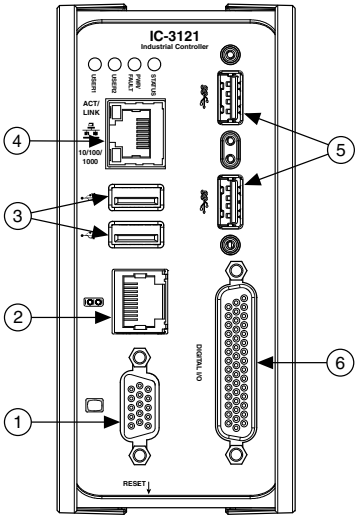
Hardware Overview

The IC-3121 front panel consists of a VGA port, RJ50 serial port, two USB 2.0 ports, a 10/100/1000 Ethernet port, and two USB 3.0 ports.

The IC-3121 front panel also includes LEDs for communicating system status and a 44-pin Digital I/O port. The Digital I/O port offers 8 isolated inputs, 8 isolated outputs, 2 bidirectional differential I/O (RS-422) or single-ended input lines that can be used with a quadrature encoder, and 8 bidirectional TTL lines.

NATIONAL INSTRUMENTS

Figure 1. IC-3121 Front Panel Connectors



1. VGA Connector
2. RS-232/RS-485 Serial Port
3. USB 2.0 Ports
4. Gigabit Ethernet Port
5. USB 3.0 Ports
6. 44-pin Digital I/O Connector

Connector Pinouts

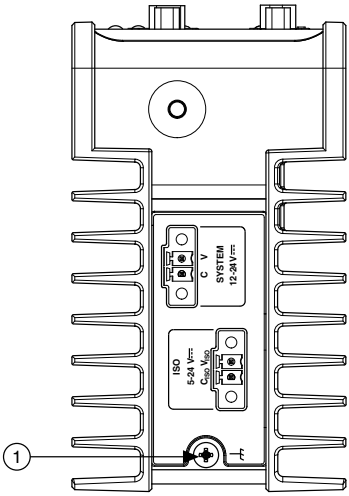
The IC-3121 provides the following connectors.

Chassis Grounding Screw

Use the grounding screw to connect the chassis to earth ground. An earth ground connection is optional.

Note An earth ground connection does not connect C or C_{ISO} to earth ground.

Figure 2. Chassis Grounding Screw



1. Chassis Grounding Screw

Power Input Connectors

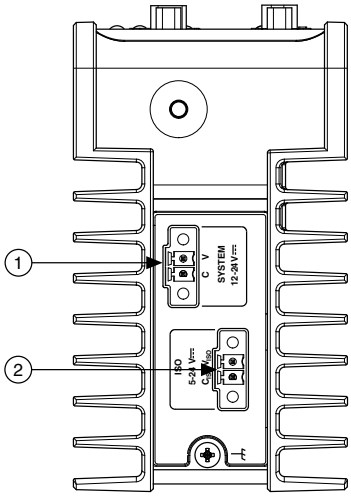
The IC-3121 requires a power supply to power the system. If needed for your application, an additional power source is required to power the isolated outputs.

The same power supply may be used for both the system power and isolated outputs power if isolation is not required and the power supply meets the voltage and power requirements for both inputs. Refer to the *IC-3121 Specifications* for power requirements.

NI recommends the following power supply for the IC-3121.

Power Supply	Part Number
NI PS-15 Industrial Power Supply, to power the system or isolated outputs	781093-01

Figure 3. Power Connectors



1. System Power Connector
2. Isolated Outputs Power Connector

Table 1. Power Connector Terminals

Terminal	Description
C	Common signal
V	System power (12-24 VDC)
C_{ISO}	Isolated common signal
V_{ISO}	Power for isolated outputs (5-24 VDC)

Ethernet Port

The IC-3121 provides a Gigabit Ethernet port. The Ethernet port provides a connection between the IC-3121, a network, and other Ethernet devices. The IC-3121 automatically detects the speed of the connection and configures itself accordingly.

A CAT 5e or CAT 6 1000Base-T Ethernet cable is required to achieve 1,000 Mbps (Gigabit) Ethernet performance. CAT 5 Ethernet cables are not guaranteed to meet the necessary requirements. While CAT 5 cables may appear to work at 1,000 Mbps, CAT 5 cables can cause bit errors, resulting in degraded or unreliable network performance.

(Windows only) The network Ethernet port provides Wake-on-LAN functionality from the power off state when associated with the Intel® driver. Wake-on-LAN must be enabled in the Power Management tab of the Intel I210 Gigabit Network Connection Properties dialog for the primary Ethernet port in Device Manager. The NI GigE Vision driver (NI-GEV) does not support Wake-on-LAN.

Figure 4. Ethernet Port Pin Locations

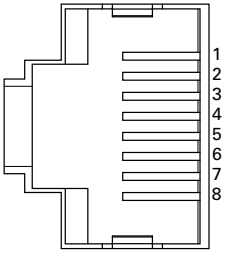


Table 2. Ethernet Port Pin Descriptions

Pin	Fast Ethernet (100 Mbps)	Gigabit Ethernet	
		MDI	MDI-X
1	TX+	BI_DA+	BI_DB+
2	TX-	BI_DA-	BI_DB-
3	RX+	BI_DB+	BI_DA+
4	No Connect	BI_DC+	BI_DD-
5	No Connect	BI_DC-	BI_DD-
6	RX-	BI_DB-	BI_DA-
7	No Connect	BI_DD+	BI_DC+
8	No Connect	BI_DD-	BI_DC-

USB 2.0 Ports

The USB ports support common USB peripheral devices such as USB flash drives, USB hard drives, USB-to-IDE adapters, keyboards, mice, and USB cameras.

(RT only) LabVIEW usually maps USB mass-storage devices to the /U, /V, /W, or /X drive, starting with the /U drive if it is available. Refer to the *LabVIEW Help* for more information.

Figure 5. USB 2.0 Pin Locations

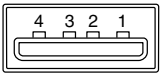


Table 3. USB 2.0 Port Pin Descriptions

Pin	Signal Name	Signal Description
1	VBUS	Cable Power (+5 VDC)
2	D-	USB Data -
3	D+	USB Data +
4	GND	Ground for power return

RS-485/422/232 Serial Port

The IC-3121 has a single serial port that can operate in either RS-485/422 mode or RS-232 mode. Set the serial port mode in the BIOS setup utility.

The serial port is a 10-position RJ50 modular jack, which can connect to serial devices, such as PLCs, scanners, and lighting devices.

NI recommends the following serial cables for the IC-3121.

Cable	Part Number
RJ50 10-position modular plug to DB-9 serial cable	182845-01 for 1 meter cable
	182845-02 for 2 meter cable
	182845-03 for 3 meter cable

Figure 6. RS-485/422/232 Serial Port Pin Locations

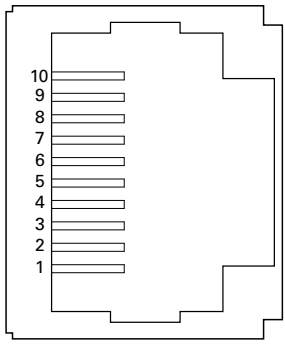


Table 4. RS-485/422/232 Serial Port Pin Descriptions

Pin	RS-485/422 Mode	RS-232 Mode
1	No Connect	No Connect
2	TXD-	Unused

Table 4. RS-485/422/232 Serial Port Pin Descriptions (Continued)

Pin	RS-485/422 Mode	RS-232 Mode
3	TXD+	Unused
4	No Connect	No Connect
5	No Connect	No Connect
6	RXD-	GND
7	RXD+	Unused
8	Unused	TXD
9	Unused	RXD
10	GND	GND

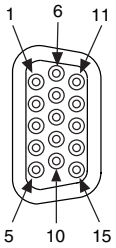
Related Information

Serial Port Configuration Submenu on page 21

VGA Port

Use the VGA port to connect a monitor to the IC-3121. Use any standard 15-pin VGA cable to access the VGA port. The VGA port has a maximum resolution of 1920 x 1200 at 60 Hz.

Figure 7. VGA Port Pin Locations



Pin	Signal Name	Signal Description
1	RED	Red analog video signal
2	GREEN	Green analog video signal
3	BLUE	Blue analog video signal
4	RESERVED	Reserved
5	GND	Ground reference
6	RED RETURN	Ground reference

Pin	Signal Name	Signal Description
7	GREEN RETURN	Ground reference
8	BLUE RETURN	Ground reference
9	PWR	5 V power for DDC
10	GND	Ground return for power
11	NC	No connect
12	DDC_D	Data signal of serial communication
13	HSYNC	Horizontal synchronization signal
14	VSYNC	Vertical synchronization signal
15	DDC_C	Clock signal of serial communication

USB 3.0 Ports

The USB ports support common USB peripheral devices such as USB flash drives, USB hard drives, USB-to-IDE adapters, keyboards, mice, and USB cameras.

(RT only) LabVIEW usually maps USB mass-storage devices to the /U, /V, /W, or /X drive, starting with the /U drive if it is available. Refer to the *LabVIEW Help* for more information.

Figure 8. USB 3.0 Port Pin Locations

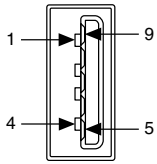


Table 5. USB 3.0 Port Pin Descriptions

Pin	Signal Name	Signal Description
1	VBUS	Cable Power (+5 VDC)
2	D-	USB Data -
3	D+	USB Data +
4	GND	Ground for power return
5	StdA_SSRX-	SuperSpeed receiver differential pair
6	StdA_SSRX+	
7	GND_DRAIN	Ground for signal return

Table 5. USB 3.0 Port Pin Descriptions (Continued)

Pin	Signal Name	Signal Description
8	StdA_SSTX-	SuperSpeed transmitter differential pair
9	StdA_SSTX+	

Digital I/O

The 44-pin Digital I/O port on the IC-3121 offers 8 isolated inputs, 8 isolated outputs, 2 bidirectional differential inputs (RS-422) or single-ended input lines that can be used with a quadrature encoder, and 8 bidirectional TTL lines. The Digital I/O port can be connected to any appropriate shielded device or connector block using a shielded cable.

NI recommends the following digital I/O cables for the IC-3121.

Cable	Part Number
44-pin D-sub male to pigtail cable	156083-03 for 3 meter cable
44-pin D-sub male to 44-position D-sub female cable	156084-03 for 3 meter cable
	156084-0R5 for 0.5 meter cable

Refer to the following image and table for pin locations and descriptions.

Figure 9. 44-pin Digital I/O Connector Pin Locations

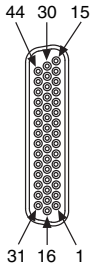


Table 6. Digital I/O Pin Descriptions

Pin Number	Signal	Description
1	Diff 0+	Bidirectional RS-422 I/O (positive side), or quadrature encoder phase A+
2	GND	Digital ground reference for TTL and differential I/O
3	TTL 0	Bidirectional TTL I/O
4	TTL 1	Bidirectional TTL I/O

Table 6. Digital I/O Pin Descriptions (Continued)

Pin Number	Signal	Description
5	GND	Digital ground reference for TTL and differential I/O
6	TTL 2	Bidirectional TTL I/O
7	TTL 3	Bidirectional TTL I/O
8	GND	Digital ground reference for TTL and differential I/O
9	Diff 1+	Bidirectional RS-422 I/O (positive side), or quadrature encoder phase B+
10	V_{ISO}	Isolated power voltage reference output
11	C_{ISO}	Common ground reference for isolated inputs and outputs
12	Iso Out 0	General purpose isolated input
13	Iso Out 1	General purpose isolated input
14	C_{ISO}	Common ground reference for isolated inputs and outputs
15	Iso Out 4	General purpose isolated output
16	Diff 0-	Bidirectional RS-422 I/O (negative side), or quadrature encoder phase A-
17	GND	Digital ground reference for TTL and differential I/O
18	TTL 4	Bidirectional TTL I/O
19	TTL 5	Bidirectional TTL I/O
20	GND	Digital ground reference for TTL and differential I/O
21	TTL 6	Bidirectional TTL I/O
22	TTL 7	Bidirectional TTL I/O
23	GND	Digital ground reference for TTL and differential I/O
24	Diff 1-	Bidirectional RS-422 I/O
25	V_{ISO}	Isolated power voltage reference output
26	C_{ISO}	Common ground reference for isolated inputs and outputs
27	Iso Out 2	General purpose isolated output
28	Iso Out 3	General purpose isolated output
29	C_{ISO}	Common ground reference for isolated inputs and outputs
30	Iso Out 5	General purpose isolated output

Table 6. Digital I/O Pin Descriptions (Continued)

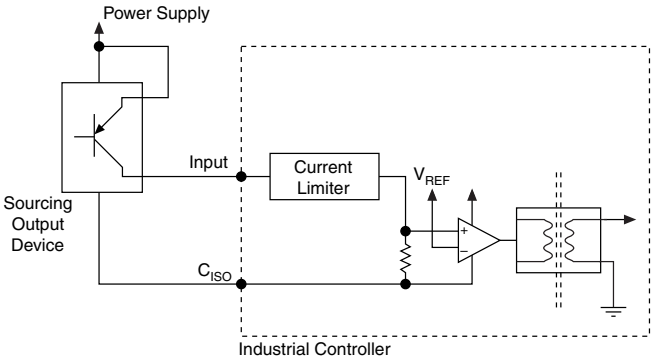
Pin Number	Signal	Description
31	Iso In 0	General purpose isolated input
32	iso In 1	General purpose isolated input
33	C_{ISO}	Common ground reference for isolated inputs and outputs
34	Iso In 2	General purpose isolated input
35	Iso In 3	General purpose isolated input
36	C_{ISO}	Common ground reference for isolated inputs and outputs
37	Iso In 4	General purpose isolated input
38	Iso In 5	General purpose isolated input
39	C_{ISO}	Common ground reference for isolated inputs and outputs
40	Iso In 6	General purpose isolated input
41	Iso In 7	General purpose isolated input
42	C_{ISO}	Common ground reference for isolated inputs and outputs
43	Iso Out 6	General purpose isolated output
44	Iso Out 7	General purpose isolated output

Wiring an Isolated Input

You can wire an isolated input to a sourcing output device.

Caution Do not allow the voltage on the isolated inputs to exceed 30 VDC. Doing so will damage the IC-3121.

Figure 10. Connecting an Isolated Input to a Sourcing Output Device



Wiring an Isolated Output

The digital isolated output circuits source current to external loads.

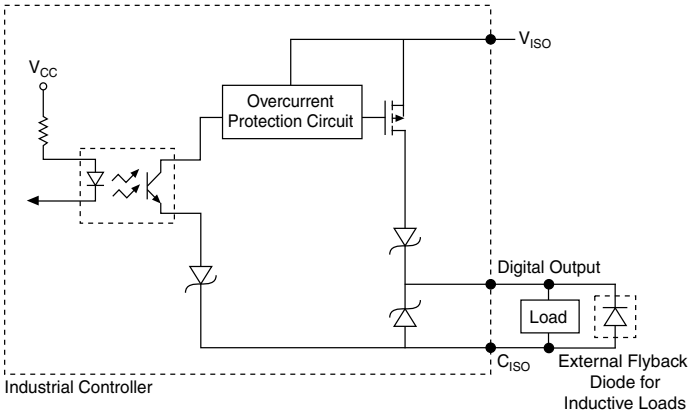
When an inductive load, such as a relay or solenoid, is connected to an output, a large counter-electromotive force may occur at switching time due to energy stored in the inductive load. This flyback voltage can damage the outputs and the power supply.

To limit flyback voltages at the inductive load, install a flyback diode across the load. Mount the flyback diode as close to the load as possible. Use this protection method if you connect any of the isolated outputs on the IC-3121 to an inductive load.

The following image shows an example of an isolated output wired to an external load with a flyback diode installed across the load.

Caution Do not draw more than 35 mA from each isolated output when V_{ISO} is 5 V. Do not draw more than 80 mA from each isolated output when V_{ISO} is 24 V.

Figure 11. Connecting an Isolated Output to an External Load



Connecting to Differential I/O

The IC-3121 accepts differential (RS-422) line driver inputs. Each of the two differential I/O can be configured as an output. Use shielded cables for all applications. Unshielded cables are more susceptible to noise and can corrupt signals.

Figure 12. Quadrature Encoder/RS-422 Input/Output Circuit

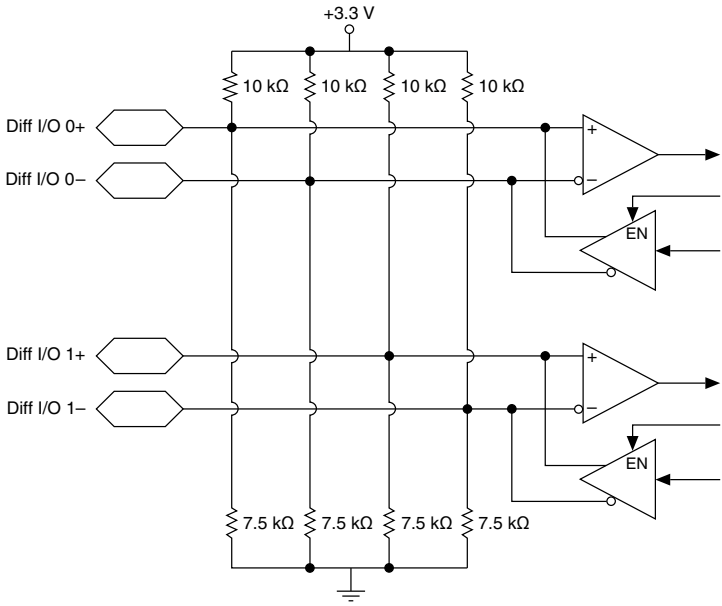


Figure 13. Connecting Differential Line Drivers

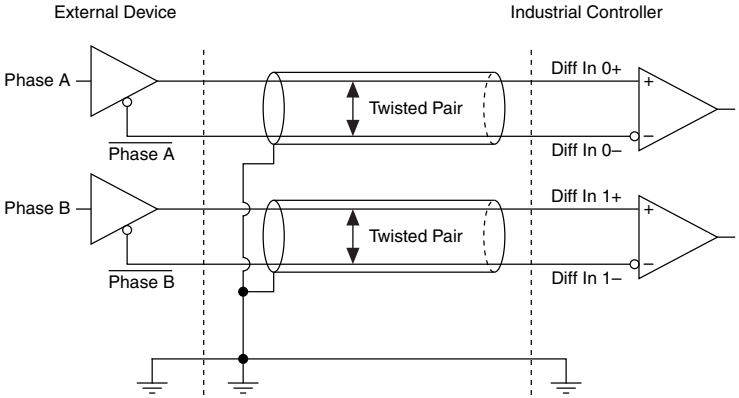
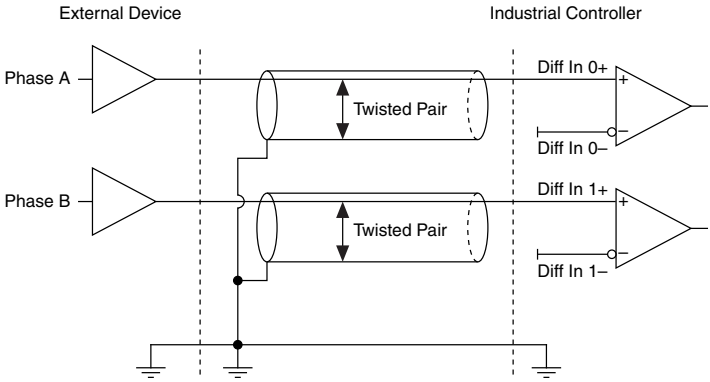


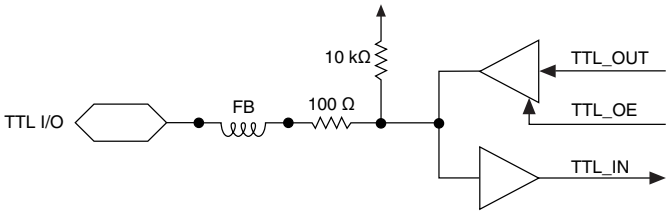
Figure 14. Connecting Single-Ended Line Drivers



TTL I/O

The following image shows the circuit for a bidirectional TTL I/O.

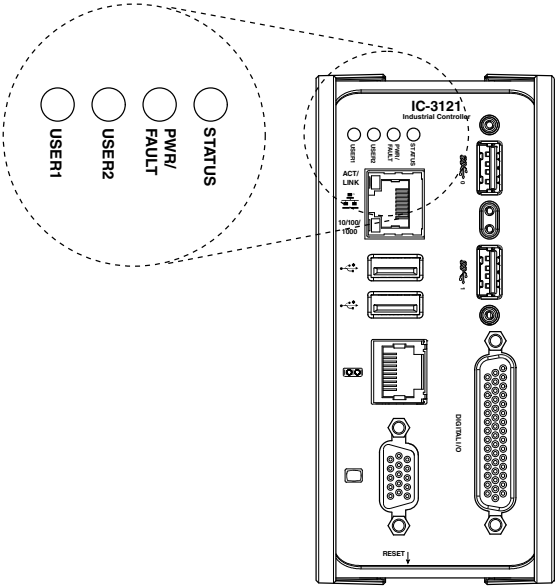
Figure 15. TTL Input/Output Circuit



LED Indicators

The IC-3121 provides the following LED indicators.

Figure 16. LED Indicators



The following table describes the LEDs and indications.

Table 7. LED Indications

LED	LED Color	LED State	Indication
STATUS	Yellow	OFF	The IC-3121 initialized successfully and is ready for use.
		2 blinks	(RT only) There is no software installed, which is the out-of-box state, or the IC-3121 has detected an error in its software. The device has automatically started up into safe mode. This usually occurs when an attempt to upgrade the software is interrupted or if system files are deleted from the IC-3121. Reinstall software on the IC-3121.
		3 blinks	(RT only) The IC-3121 has booted into safe mode. Refer to the *Safe Mode* section for information about the safe mode state.
		4 blinks	(RT only) The IC-3121 has experienced two consecutive software exceptions. The IC-3121 automatically restarts after an exception. After the second exception, the IC-3121 remains in the exception state, alerting you to resolve the problem. Reinstall software on the IC-3121 or contact NI for assistance. Refer to the *IC-3121 Getting Started Guide* for information about installing software on the IC-3121.
		Continuous blinking	(RT only) The IC-3121 has not booted into NI Linux Real-Time. The controller either booted into an unsupported operating system, was interrupted during the boot process, or detected an unrecoverable software error.
		Solid	(RT only) The IC-3121 is booting up. (Windows only) An internal drive is being accessed.

Table 7. LED Indications (Continued)

LED	LED Color	LED State	Indication
PWR/ FAULT	—	OFF	The IC-3121 is OFF. This is not an indication of whether power is applied or not.
	Green	Solid	The IC-3121 is operating normally and is properly powered on.
	Red	Blinking	The IC-3121 power-up sequence failed.
USER1/ USER2	Green/ Yellow	—	User-controlled LEDs that can be controlled using the NI System Configuration API.

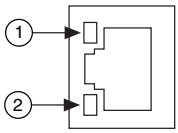
Related Information

Safe Mode on page 18

Ethernet LEDs

The Gigabit Ethernet port has the following LEDs.

Figure 17. LEDs for the Gigabit Ethernet Port



1. Activity/Link LED
2. Speed LED

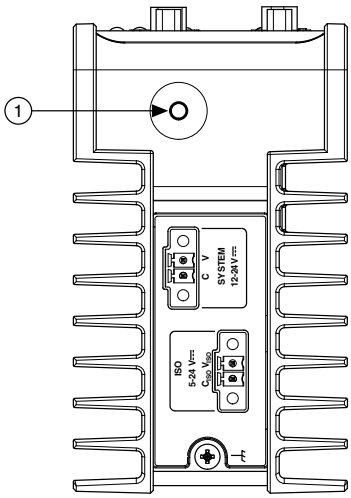
Table 8. Ethernet LED Indications

LED	Status	Indication
Activity/Link	Unlit	No link has been established
	Solid	A link has been established
	Blinking	Activity on the link
Speed	OFF	No link, or 10 Mbps link
	Green	100 Mbps link
	Amber	1,000 Mbps link

Using the RESET Button

Pressing the RESET button resets the processor and reboots the system.

Figure 18. RESET Button Locations



1. RESET Button

(RT only) Troubleshooting Network Connectivity

Use the RESET button to troubleshoot network connectivity.

1. Hold the RESET button for 5 seconds, and then release it to boot the IC-3121 into safe mode.
2. After booting the controller into safe mode, hold the RESET button again for 5 seconds to enable IP reset, which resets the network adapter to its default configuration.

Safe Mode

When you boot the IC-3121 into safe mode, it launches only the services necessary for updating its configuration and installing software. To resume normal operations, press the RESET button for less than 5 seconds.

IP Reset

Use IP reset to reset the TCP/IP settings when moving the system from one subnet to another or when the current TCP/IP settings are invalid.

When the IC-3121 is in the IP reset state, the IP address of the network port resets to DHCP or a link-local address. You can then set up a new network configuration for the IC-3121 from a

development machine on the same subnet, or you can connect the IC-3121 directly to the development computer.

Note By default, the target automatically attempts to connect to the network using DHCP. If the target is unable to initiate a DHCP connection, the target connects to the network with a link-local IP address (169.254.x.x).

Software Options

Use the following software to develop applications with the IC-3121. Refer to the *IC-3121 Getting Started Guide* for information about installing software.

- NI Industrial Controller Device Drivers 15.5 or later driver software.
- One of the following options for developing machine vision applications:
  - LabVIEW 2014 SP1 or later, LabVIEW Real-Time 2014 SP1 or later, the NI Vision Development Module 2015 SP1 or later.
  - NI Vision Builder for Automated Inspection (Vision Builder AI) 2015 or later.
- Software for using and reconfiguring the IC-3121 FPGA. Different configurations are referred to as hardware personalities, and are defined by bitfiles. NI Industrial Controller Device Drivers include a reconfigurable I/O personality that you can use out of the box. Install the following software if you need to compile a custom personality for your application:
  - LabVIEW 2014 SP1 or later and LabVIEW FPGA Module 2014 SP1 or later—You must install the LabVIEW FPGA Module to reconfigure the default personality of the IC-3121 FPGA.

BIOS Configuration and System Recovery

You can change the configuration settings for the IC-3121 in the BIOS setup utility. The BIOS is the low-level interface between the hardware and PC software that configures and tests your hardware when you boot the system. The BIOS setup utility includes menus for configuring settings and enabling features.

Most users do not need to use the BIOS setup utility. The system ships with default settings that work well for most configurations.

Entering BIOS Setup

Complete the following steps to start the BIOS setup program.

1. Connect a monitor to the VGA connector on the IC-3121.
2. Connect a USB keyboard to one of the USB ports on the IC-3121.
3. While holding down the <Delete> key, power on or reboot the IC-3121.

The IC-3121 will enter the BIOS setup program and display the **Main** menu.

BIOS Keyboard Navigation

Use the following keys to navigate through the BIOS setup:

- Left, right, up, and down arrows—Use these keys to move between different setup menus. Press <Esc> to exit a submenu. Be sure number lock is off to use the numeric keypad arrows.
- <Enter>—Use this key to either open a submenu or display all available settings for the highlighted configuration option.
- <Esc>—Use this key to return to a parent menu of a submenu or cancel an outstanding selection. At the main menu, use this key to exit the BIOS setup.
- <+> and <->—Use these keys to cycle between all available settings.
- <Tab>—Use this key to select time and date fields. When entering date and time and date information, you can also use the number keys to enter the time and date directly.
- <F9>—Use this key to load the optimal default values for BIOS configuration settings. The optimal default values are the same as the shipping configuration default values.

Press <F1> from any root menu to display more information about navigating the BIOS setup program.

Menu items listed in blue are changeable; menu items in gray are not changeable. A blue triangle next to a menu item indicates that the menu item contains a submenu.

Main Menu

The most commonly accessed and modified BIOS settings are in the Main setup menu.

- System Date—Changes the system date. The system date setting is stored in a batter-backed real-time clock. You can also change this setting from within MAX or Vision Builder AI.
- System Time—Changes the system time. The system time setting is stored in a battery-backed real-time clock. You can also change this setting from within MAX or Vision Builder AI.

Advanced Menu

This menu contain BIOS settings that normally do not require modification. If you have specific problems such as unbootable disks or resource conflicts, you may need to examine these settings.

The Advanced setup menu includes the following submenus:

- Power/Wake Configuration
- Serial Port Configuration
- SATA Configuration
- USB Configuration

Power/Wake Configuration Submenu

Use this submenu to apply alternate configurations to the power features of the chipset and controller. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- Restore After Power Loss—Specify what state to go to when power is reapplied after a power failure.

Serial Port Configuration Submenu

Use this submenu to view the serial port configuration.

- RS485/RS232 Select—This setting selects the transceiver mode between RS-232 and RS-485. The default value is **RS485**.
- RS-485 Configuration—Use this menu to configure the RS-485/422 wire-mode. The default value is **Auto**.

Related Information

RS-485/422/232 Serial Port on page 6

SATA Configuration Submenu

Use this submenu to apply custom configurations to the processor of the IC-3121. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- SATA Controller(s)—Enables or disables the SATA controller. The default is **Enabled**.

USB Configuration Submenu

Use the submenu to apply alternate configurations to the USB ports. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- Legacy USB Support—Specifies whether or not legacy USB support is enabled. Legacy USB support refers to the ability to use a USB keyboard and mouse during system boot or in a legacy operating system such as DOS. The default is **Enabled**.
- Overcurrent Reporting—Enables or disables operating system notifications of USB overcurrent events. The default is **Disabled**.
- Transfer Timeout—Specifies the number of seconds the POST waits for a USB mass storage device to start. The default is **20** seconds.
- Device Reset Timeout—Specifies the maximum amount of time a device can take to properly report itself during the POST. The default value is **Auto**. Alternatively, the **Manual** override setting can be used to support slow USB devices.
- Mass Storage Devices—When USB storage is connected to the device, this menu lists each USB drive. You can set the emulation type of the USB storage. The options include Auto, Floppy, Forced FDD, Hard Disk, and CD-ROM. The default is **Auto**.

Boot Menu

This screen displays the boot order of devices associated with the IC-3121. The BIOS proceeds down the **Boot priority order list** in search of a bootable device. Devices under the

Excluded from boot order list will not be used for booting. If the BIOS fails to find any bootable device, an error message is displayed.

The Boot setup menu includes the following submenus:

- Boot Settings Configuration—Use this setting to access the **Boot Settings Configuration** submenu.
- PXE Network Boot—This setting specifies whether or not the PXE network boot agent is enabled. When this setting is enabled, the Intel Boot Agent is displayed in the **Boot Option Priorities** menu, allowing you to boot from a PXE server on the local subnet. Note that the Intel Boot Agent device names are preceded by **IBA GE Slot** in the **Boot Option Priorities** menu. The system must be restarted for this setting to take effect. The default value is **Disabled**.
- Boot Option Priorities—These setting specify the order in which the BIOS checks for bootable devices, including the local hard disk drive, removable devices such as USB flash disk drives or USB CD-ROM drives, or the PXE network boot agent. The BIOS will first attempt to boot from the device associated with **Boot Option #1**, followed by **Boot Option #2** and **Boot Option #3**. If multiple boot devices are not present, the BIOS setup utility will not display all of these configuration options. To select a boot device, press <Enter> on the desired configuration on the desired configuration option and select a boot device from the resulting menu. You can also disable certain boot devices by selecting **Disabled**.



Note Only one device of a given type will be shown in this list. If more than one device of that same type exists, use the Device BBS Priorities submenus to re-order the priority of devices of the same type.

Boot Settings Configuration Submenu

- Setup Prompt Timeout—This setting specifies the amount of time the system waits for a BIOS Setup menu keypress (the <Delete> key) in units of a second. The default value is **1** for a delay of one second.
- Bootup NumLock State—This setting specifies the power-on state of the keyboard NumLock setting. The default value is **On**.

Device BBS Priority Submenus

The following submenus will be displayed if one or more bootable devices of the corresponding type is present:

- Hard Drive BBS Priorities
- CD/DVD ROM Drive BBS Priorities
- Floppy Drive BBS Priorities
- Network Device BBS Priorities

Hard Drive BBS Priorities Submenu

- Boot Option #1, Boot Option #2, Boot Option #3—These settings specify the boot priority of hard drive devices. The highest priority device is displayed on the main **Boot Option Priorities** list. Optionally, each device can also be **Disabled** if the device should never be used as a boot device.

CD/DVD ROM Drive BBS Priorities Submenu

- Boot Option #1, Boot Option #2, Boot Option #3—These settings specify the boot priority of CD/DVD ROM drive devices. The highest priority device is displayed on the main **Boot Option Priorities** list. Optionally, each device can also be **Disabled** if the device should never be used as a boot device.

Floppy Drive BBS Priorities Submenu

- Boot Option #1, Boot Option #2, Boot Option #3—These settings specify the boot priority of network devices. The highest priority device is displayed on the main **Boot Option Priorities** list. Optionally, each device can also be **Disabled** if the device should never be used as a boot device.

Network Device BBS Priorities Submenu

- Boot Option #1, Boot Option #2, Boot Option #3—These settings specify the boot priority of network devices. The highest priority device is displayed on the main **Boot Option Priorities** list. Optionally, each device can also be **Disabled** if the device should never be used as a boot device.

Save & Exit Menu

The Save & Exit setup menu includes all available options for exiting, saving, and loading the BIOS default configuration. You can also press <F9> to load BIOS default settings and <F10> to save changes and exit setup.

The Save & Exit setup menu includes the following settings:

- Save Changes and Reset—Any changes made to BIOS settings are stored in NVRAM. The setup utility then exits and reboots the controller.
- Discard Changes and Reset—Any changes made to BIOS settings during this session of the BIOS setup utility since the last save are discarded. The setup utility then exits and reboots the controller. The <Esc> key can also be used to select this option.
- Save Changes—Changes made to BIOS settings during this session are committed to NVRAM. The setup utility remains active, allowing further changes.
- Discard Changes—Any changes made to BIOS settings during this session of the BIOS setup utility since the last save are discarded. The BIOS setup continues to be active.
- Restore Factory Defaults—This option restores all BIOS settings to the factory default. This option is useful if the controller exhibits unpredictable behavior due to an incorrect or inappropriate BIOS setting. Any nondefault settings are also restored to their factory defaults. The <F9> key can also be used to select this option.
- Save as User Defaults—This option saves a copy of the current BIOS settings as the User Defaults. This option is useful for preserving custom BIOS setup configurations.
- Boot Override—This option lists all possible bootable devices and allows the user to override the **Boot Option Priorities** list for the current boot. If no changes have been made to the BIOS setup options, the system will continue booting to the selected device without first rebooting. If BIOS setup options have been changed and saved, a reboot is required and the boot override selection will not be valid.

Restoring the NI Linux Real-Time Operating System

Complete the following steps to restore the NI Linux Real-Time operating system to its factory default condition. These steps do not restore the BIOS settings to factory default. Use the **Restore Defaults** option in the *Save & Exit Menu* of the BIOS setup utility to restore the BIOS settings.

Caution Restoring the operating system erases the contents of the hard drive. Back up any files you want to keep before restoring the hard drive.

1. Start the IC-3121 in safe mode. To start in safe mode, apply power, turn on the device, press the RESET button for more than 5 seconds, then release the button.
2. Launch NI MAX on the development computer.
3. In the MAX configuration tree, expand **Remote Systems**.
4. Right-click the name of the IC-3121 you want to restore and select **Format Disk**.
5. Enter the username and password for the device. By default, the username is `admin` and the password field is blank.
6. Click **Format**.
7. After formatting is complete, a confirmation dialog window appears. Click **Close**.
8. Refer to the *IC-3121 Getting Started Guide* for information about installing software and configuring the device.

Related Information

Safe Mode on page 18

Restoring the Windows Operating System

You can restore the Windows operating system on the hard drive of the IC-3121 from the reinstallation DVD shipped with device.

Note Restoring the operating system erases the contents of the hard drive. Back up any files you want to keep before restoring the hard drive.

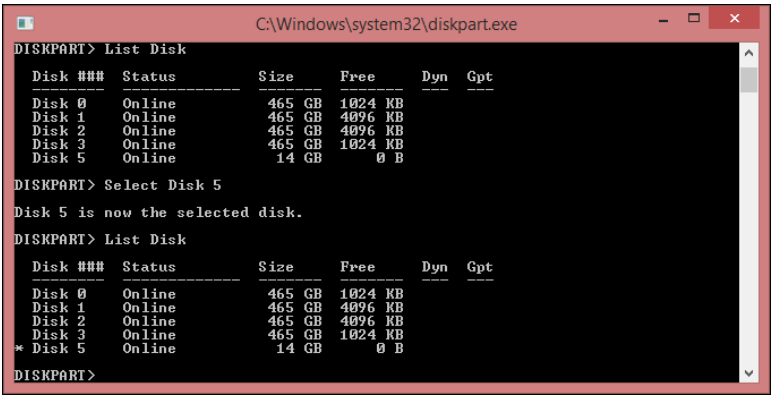
Creating a Bootable USB Flash Drive

You can create a bootable USB flash drive from the reinstallation DVD if you do not have a USB DVD drive to connect to the IC-3121. The USB flash drive must be at least 8 GB. Ensure the USB flash drive appears as a Removable Drive in Windows. Avoid using drives that appear as Fixed Disk drives. Complete the following steps to prepare the USB flash drive for recovery.

Note If you have an external USB DVD drive, you can use the external DVD drive to restore Windows without creating a bootable USB flash drive. Proceed to the next section if you are using an external DVD drive.

1. Insert the USB flash drive into a computer with a DVD drive running Windows, and wait for the flash drive to be recognized.
2. Open a command prompt as an administrator.

3. Type `diskpart.exe` and press <Enter>.
4. Type `list disk` and press <Enter>.
5. Identify the drive number that corresponds to the USB flash drive.
6. Type `select disk x`, where *x* is the drive number of the USB flash drive, and press <Enter>. For example, in the following image, the USB flash drive is disk number 5. The command is `select disk 5`.



Caution Following this process will delete all data on the USB flash drive.

7. Type `clean` and press <Enter>. This command deletes all data from the USB flash drive.
8. Type `create partition primary` and press <Enter>.
9. Type `active` and press <Enter>
10. Type `format fs=ntfs quick` and press <Enter> to format the USB flash drive.
11. Type `assign letter` *`free volume letter`*, where *`free volume letter`* is a letter not currently associated with any disk drives. For example, `assign letter K`.
12. Copy the contents of the reinstallation DVD to the root of the USB flash drive.

    The USB flash drive is now bootable and will install Windows.

Reinstalling Windows

Complete the following steps to use the recovery media to install Windows.

1. Connect the bootable USB flash drive to one of the USB ports on the IC-3121. Or connect an external DVD drive to one of the USB ports on the IC-3121 and insert the recovery DVD into the external drive.
2. Connect a USB hub to the other USB port on the IC-3121. Connect a keyboard and mouse to the USB hub. If a USB hub is not available, the keyboard can be used to navigate the recovery software.
3. Power on the IC-3121.
4. Press the <F10> key on the keyboard.

5. Select the bootable USB flash drive or the DVD drive.
6. Press any key to boot from the recovery media.
7. Follow the on-screen instructions to format the hard drive and install the operating system.

After restoring the operating system, reinstall any software and drivers onto the IC-3121.

Mounting the IC-3121

This section provides information for creating a custom mount for the IC-3121. If you do not want to create a custom mount, a panel and DIN rail mount kit for the IC-3121 is available from National Instruments (part number 781740-01).

Caution If you choose not to mount the IC-3121 on a DIN rail or flat surface, do not position the IC-3121 with the heat sinks resting on any surface. Doing so may cause the IC-3121 device to overheat. Refer to the *IC-3121 Specifications* for temperature specifications.

The following figures provide dimensional drawings and clearance information for the IC-3121.

Figure 19. Front View with Dimensions in inches [millimeters]

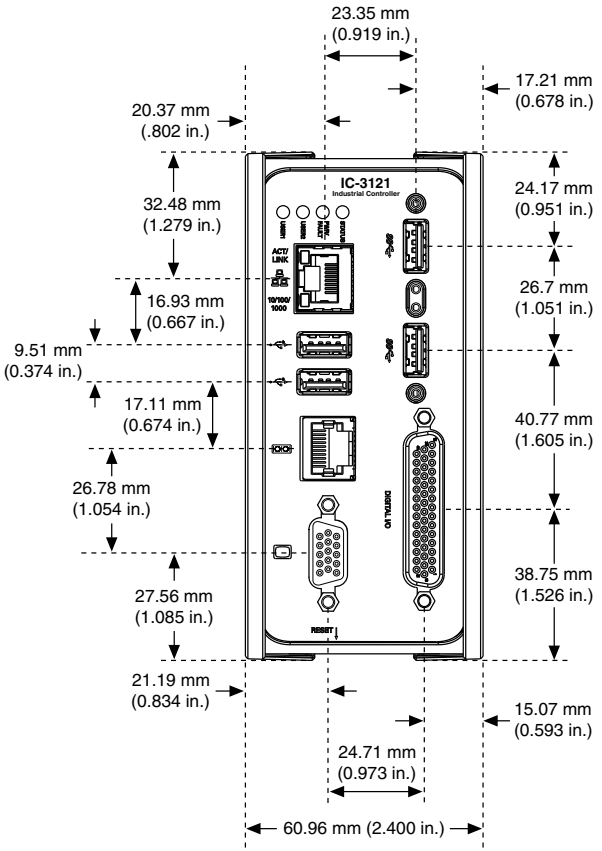


Figure 20. Back View with Dimensions in inches [millimeters]

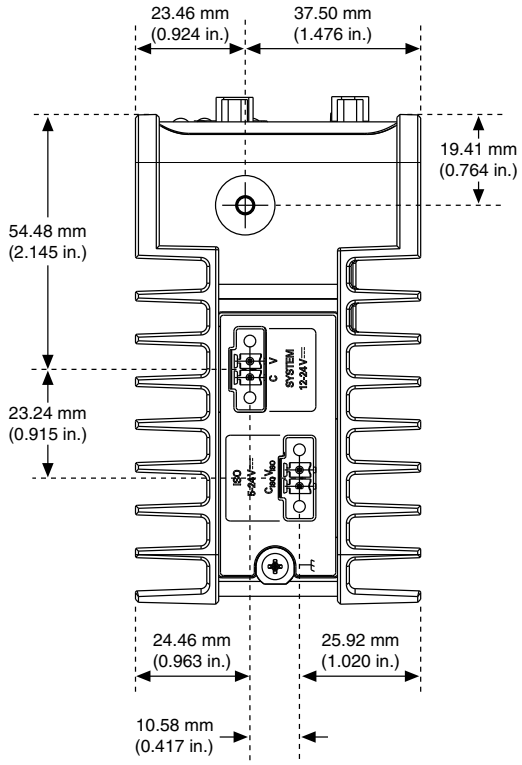


Figure 21. Side View with Dimensions in inches [millimeters]

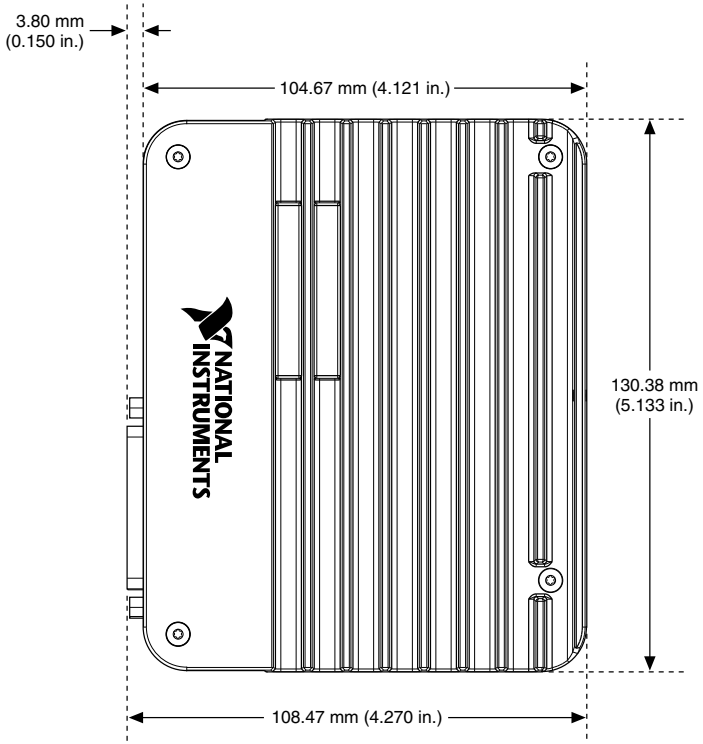
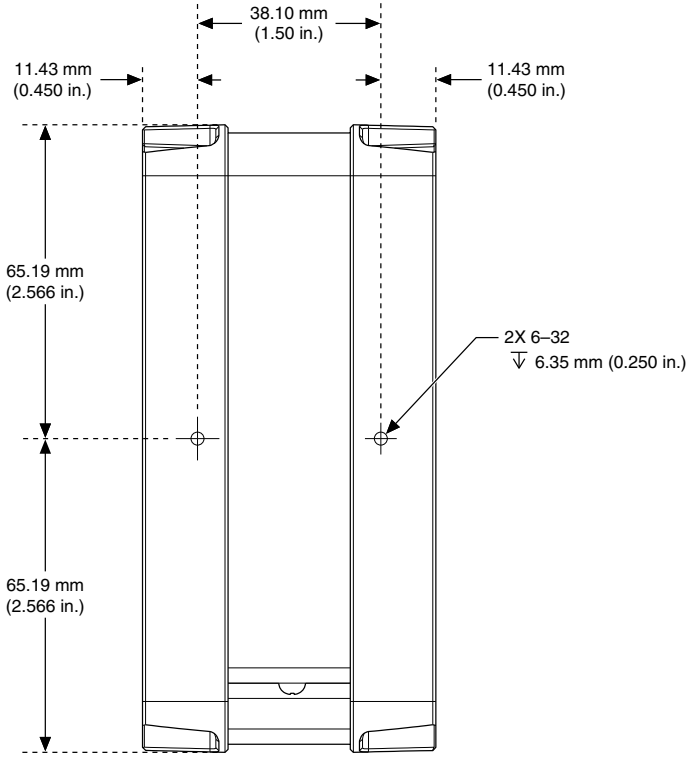


Figure 22. Bottom View with Dimensions in inches [millimeters]



Securing the IC-3121 to a Mount

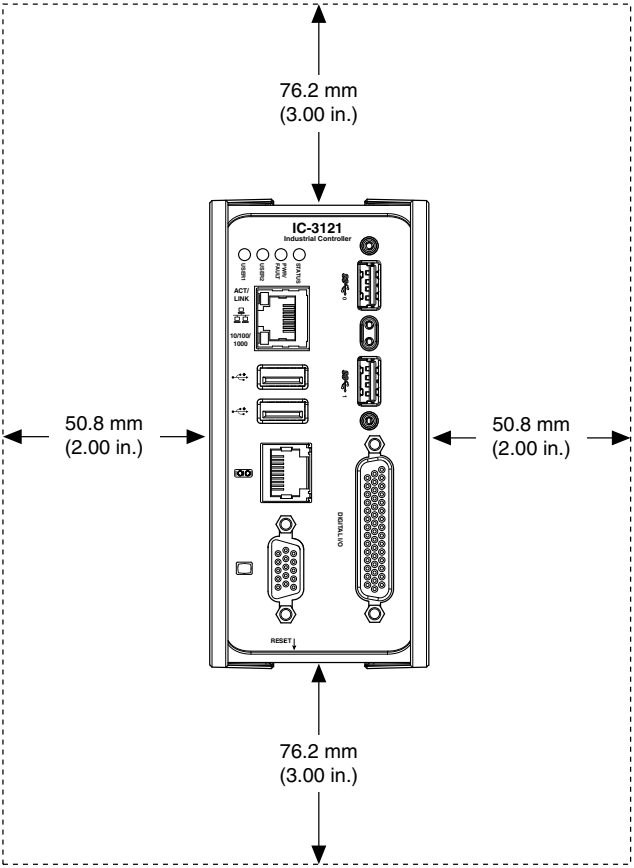
1. Align the screw holes of the mounting bracket with the two holes on the back of the IC-3121.
2. Insert two 6-32 screws and tighten them until they are secure (3.5 in-lb). Make sure the heads of the screws are flush with the mounting bracket.

Clearance Requirements

The IC-3121 installation must meet the following space and cabling clearance requirements for optimum cooling:

- Allow 76.2 mm (3.0 in.) on the top and bottom of the IC-3121 for air circulation.
- Allow 50.8 mm (2.0 in.) on the sides of the IC-3121 for air circulation.
- Allow enough space in front of the IC-3121 to connect cables.

Figure 23. Clearance Requirements for the IC-3121



Where to Go Next

The following documents and resources contain information you may find helpful as you use the IC-3121 in an application. Refer to the National Instruments Product Manuals Library at *ni.com/manuals* for the most recent versions of product documentation.

- *IC-3121 Specifications*—Contains detailed specifications for the IC-3121.
- *IC-3121 Getting Started Guide*—Explains how to install and configure the software necessary to use the IC-3121, and how to get started using the hardware.
- *NI CVS I/O Accessory User Manual*—Contains installation and operation instructions for the NI CVS I/O Accessory.

Worldwide Support and Services

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